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Announcement

Call for Papers: Biomedical Complexity and Error Special Issue

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Submission Deadline: February 1, 2009

We are soliciting papers for a special issue of *Journal of Biomedical Medical Informatics* that will focus on the state-of-the-art in research theories and methods regarding the nature of complexity and its relationship to error. The focus will be on biomedical environments, although we also seek papers from domains outside biomedicine if there is a cogent discussion of the implications for healthcare.

In assessing the progress towards patient safety since the release of the Institute of Medicine (IOM) seminal report “To Err Is Human” (Kohn et al., 2000), it has been noted that while the report raised awareness of medical error, little evidence exists to indicate that there have been subsequent systematic improvements in health care safety. One of the recognized barriers to meeting this grand challenge has been the complexity of the healthcare decision-making environment (Leape and Berwick, 2005). This observation highlights the need for approaches to error that address the complex nature of healthcare work. The framework of individual accountability is poorly suited to the problem of medical errors, as it isolates erroneous action from its larger context. In addition, and in keeping with contemporary human error research, investigators have begun to acknowledge that currently prevalent approaches seeking to eradicate error fail to recognize that error recovery (rather than absolute error prevention) is integral to any cognitive work. In response, a new approach to medical error that focuses on the emergence, detection, and management of error within a complex cognitive system has been gaining momentum.

The study of complex systems offers insights that are applicable to the study of distributed cognitive systems, which are systems composed of networks of heterogeneous human and machine agents. A complex cognitive system underlies the decision-making process in cooperative workplaces, as exemplified by the critical care environment. At a theoretical level, these approaches consider technology, as well as other artifacts, as an integral part of the distributed cognitive system of the environment. Such an integrated approach to errors and complexity has been approached in a multidisciplinary and transdisciplinary manner by researchers. Methodologies that capitalize on advances in technology to facilitate data collection and analysis and to develop intervention studies are being developed in a variety of domains such as aviation, the military, healthcare, and interventions by first response teams.

Understanding human limits and failures of their decision-making is important if we are to build robust decision-support systems. It is important to explore lessons learned from both natural and human-made systems that display a high degree of robustness to component failures. One of the purposes of this special issue will be to reexamine error research within the context of complexity and to have people from different disciplines provide insight into new scientific theories and methods that will help us to understand and resolve some of the outstanding challenges of errors in biomedical domains (Patel and Cohen, 2008).

This issue is timely in that there has been a rapid increase in the number of research efforts in the application of research methods and tools from complexity science and resilience engineering to the study of biological natural environments and social networks. It has been inspired by a “think tank” symposium organized at Arizona State University and sponsored by James S McDonnell Foundation in October, 2008. The issue will provide a focused venue for outlining the relevant research topics in the area of complex systems and their application to the biomedical domains, including critical care. Investigators from a number of domains, including complexity science, are invited to submit original and review articles that will serve as seminal texts for the study of complexity and error in biomedicine. We hope that the special issue will serve as a catalyst to encourage subsequent multidisciplinary research in error management.

The topics of interest for this special issue include but are not limited to:

1. Theory of Complex Systems

The study of complex systems draws together emerging approaches from several diverse fields including economics, physics, biology, mathematics, and computer science on the common ground of complexity. This interdisciplinary effort seeks to formulate unifying principles of complexity. Such principles provide a common framework for applying complex systems approach across domains enables a

qualitative and quantitative study of the nature of various domains and allows for prediction and evaluation of different types of interventions in complex systems. Papers that present the latest advances in the theory, research, and methods of complex systems are solicited.

2. Nature of Complexity and Error: Lessons from non-Biomedical Domains

Several concepts drawn from the complex systems literature are pertinent to the study of a biomedicine, including the critical-care unit (ICU or CCU) as a complex cognitive system. Elements of complex systems theory such as aggregation, non-linearity, flows, and diversity can be suitably applied to critical-care environments and provide useful insights into functioning of the biomedicine in terms of workflow, communication, human-technology interaction, team behavior, etc. Papers that apply complex systems theory to study various facets of biomedical environments are solicited.

3. Complexity and Error in Healthcare Systems, including Critical Care

Several error-related concepts have immediate parallels to concepts drawn from complexity science. Complexity science can enable detailed understanding of errors and error-prevention mechanisms and culture. Studies in this domain have hypothesized both a positive correlation between errors and complexity wherein complexity is seen as a cause for errors, and a negative correlation between errors and complexity wherein complexity has been linked with increased resilience to errors. Papers encompassing approaches that study the relation between complexity and errors, including human resilience, are solicited.

4. Complexity and Error Interventions

Interventions designed to reduce errors in complex environments need to account for the nature of the environments. On-the-job situational awareness tools, educational environments such as virtual-reality-based simulations and team-training protocols that are based on error ontology, and workflow-centered models pertaining to complex systems can provide an adequate basis for error prevention and encouraging a culture of safety. Papers that present theory-driven interventions are specifically solicited for this special issue.

Peer-Review Process

All submitted papers will go through a rigorous peer-review process with at least two reviewers. The acceptance process will focus on those papers that address innovative theories and methods that underlie our understanding of the nature of the complexity and error. All submissions should follow the guidelines for authors available at the *Journal of Biomedical Informatics* web site (<http://www.elsevier.com/locate/yjbin>). JBI's editorial policy is also outlined on that page and will be strictly followed by special issue reviewers.

Submission Process

Authors must submit their paper via the online Elsevier Editorial System (EES) at <http://ees.elsevier.com/jbi>. Authors can register and upload their text, tables, and figures as well as subsequent revisions through this website. Potential authors may contact the Publishing Services Coordinator in the journal's editorial office (jbi@elsevier.com) for questions regarding this process.

References

- Kohn L, Corrigan J, Donaldson M, eds. *To Err Is Human: Building a Safer Health System*. Committee on Quality of Health Care in America, Institute of Medicine. National Academy Press, Washington DC (2000).
- Leape LL, Berwick DM., "Five Years After To Err Is Human: What Have We Learned?" *Journal of the American Medical Association* 293 (2005): 2384–90.
- Patel VL, Cohen T (2008). New Perspectives on Error in Critical Care, *Current Opinions in Critical Care*, Volume 14, No. 4, pp 456–9.